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U.S. Dept. of Interior

American Woodcock

Harvest and Breeding Population Status, 1990

Department of the Interior

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AMERICAN WOODCOCK HARVEST AND BREEDING POPULATION STATUS, 1990

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Abstract: Wing-collection and Singing-ground Surveys were conducted to determine the population status of American Woodcock. Age ratio information from harvested woodcock provides an index to recruitment (ratio of immatures per adult female) between 1988 and 1989. In the U. S. portion of the Eastern Region recruitment declined 6.3% from 1.6 to 1.5 immatures per adult female. In the U. S. portion of the Central Region recruitment indices increased 13.3 % from 1.5 to 1.7 immatures per adult female. Between 1988 and 1989, there were no changes in woodcock hunting regulations, however, indices of hunting success (average daily and seasonal bags) remained unchanged in the Eastern Region and declined in the Central Region. Eastern Region daily success remained at 1.6 woodcock bagged per day in both 1988 and 1989. Eastern seasonal success also remained unchanged at 8.8 per hunter per season in both 1988 and 1989. In the Central Region the daily success index decreased 7.7% from 2.6 birds per day in 1988 to 2.4 birds per day in 1989. The Central Region seasonal success index decreased 6.7% from 13.5 to 12.6 birds per season. Analysis of Singing-ground Survey data using route regression methodologies indicates a nonsignificant decline of 2.5% between 1989 and 1990 in the Eastern Region and a significant long-term decline of 1.8% per year. The Eastern Region woodcock population has shown no significant change since the implementation of restrictive regulations in 1985. Route regression results for the Central Region breeding population shows a non-significant 2.5% increase between 1989 and 1990. Long-term trends indicate a non-significant annual decrease of 0.8% in the Central Region breeding population index.

The American woodcock (*Scolopax minor*) is a popular gamebird throughout eastern North America, providing an estimated 3.4 million-person-days of hunting annually (U.S.D.I. 1988). Maintenance of woodcock populations at levels that provide recreational opportunities for the hunting and nonhunting public is a management objective of the Fish and Wildlife Service (FWS). To meet this objective and to conform to the requirements of the Migratory Bird Treaty Act the FWS in cooperation with the Canadian Wildlife Service and 39 state and provincial fish and wildlife agencies conducts two annual surveys of woodcock populations. These surveys are designed to allow biologists to monitor the status of woodcock populations and to aid wildlife administrators in setting hunting regulations.

These two surveys are the Wing-collection survey and the Singing-ground Survey. Each fall a sample of hunters submit a wing from each woodcock they bag and supplemental information on effort and success.

These data provide indices on woodcock recruitment during the previous spring, and hunter effort and success. The spring Singing-ground Survey provides an index to the current breeding population. These surveys are inadequate in several respects; however, they provide the best currently available information on woodcock population status.

Distribution and Abundance

Woodcock breed throughout most of eastern North America (Owen 1978) (Fig. 1). Woodcock biologists recognize two relatively discrete populations as defined by Glasgow (1958), Martin et al. (1969), and Krohn et al. (1974). Detailed analyses of band recovery data generally support the existence of

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The primary purpose of this report is to facilitate the prompt distribution of timely information. Results are preliminary and may change in the final analysis with the inclusion of additional data.

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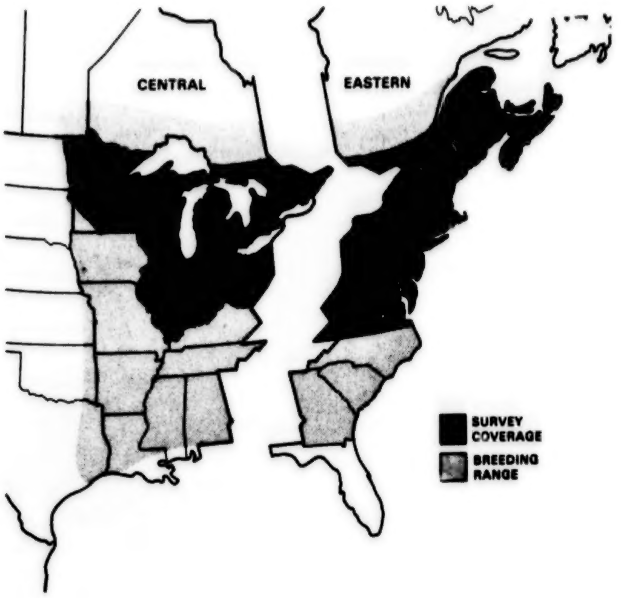

Fig. 1. Woodcock breeding range, singing ground coverage, and woodcock management regions.

these populations (Coon et al. 1977). Woodcock are therefore managed in two separate management units (Fig. 1).

Population Monitoring

Reliable annual estimates of population size, recruitment, harvest size and distribution are fundamental to comprehensive woodcock management. Unfortunately, this information is difficult and often impractical to obtain. Woodcock are difficult to find and count because of their cryptic coloration, small size, and preference for densely vegetated habitat. Also, no comprehensive sampling frame for woodcock hunters exists. Therefore, the Wing-collection Survey and Singing-ground Survey were developed to provide indices of the recruitment of young into the population and harvest levels.

Wing-collection Survey.--The Wing-collection Survey was developed in the early 1960's to monitor the recruitment of woodcock. Without a sampling frame, woodcock hunters were solicited from state fish and game agencies and from duck stamp purchasers who indicated that they also hunt woodcock. Survey participants also include hunters who: (1) participated in the previous year's survey; (2) requested that they be included in the survey; or (3) indicated on a state or federal harvest survey that they hunted woodcock in the previous hunting season. Serious questions exist about the survey because these hunters are solicited non-randomly from these limited groups and they often participate in the survey every year, possibly biasing the results.

Singing-ground Survey.--The Singing-ground Survey was developed to exploit the conspicuous courtship display that male woodcock exhibit at twilight during early spring. Early studies demonstrated that counts of singing males provide indices to woodcock populations and can be used to monitor annual changes (Mendall and Aldous 1943, Goudy 1960, Duke 1966, and Whitcomb 1974). Before 1968, counts were conducted on non-randomly located routes. Beginning in 1968, routes were relocated by placing them in the center of randomly chosen 10-minute blocks within each state and province in the mid- and northern portions of the woodcock's breeding range (Fig. 1). The current survey consists of approximately 1,500 routes; however, one third of these routes are carried as "constant zero" routes. These routes are assumed to have no singing males and are usually located in areas of marginal or poor woodcock habitat.

METHODS

Wing-collection Survey

Participants were selected non-randomly from the pool of past cooperators, state or federal survey respondents who harvest woodcock, and individuals requesting to be included in the survey. Participants were provided with prepaid mailing envelopes and asked to submit one wing from each woodcock they bagged and to provide supplemental information about their hunting party's activities.

Age and sex ratios in the harvest were determined by examining plumage characteristics (Martin 1964) during the FWS annual wingbee (a cooperative work session). The ratios provide information on the recruitment of young into the population during the 1989 breeding season. Hunting success statistics were compiled from supplemental information provided by successful hunters who participated in both 1988 and 1989. Both success and recruitment data were weighted to compensate for differences in the proportion of hunters sampled among states.

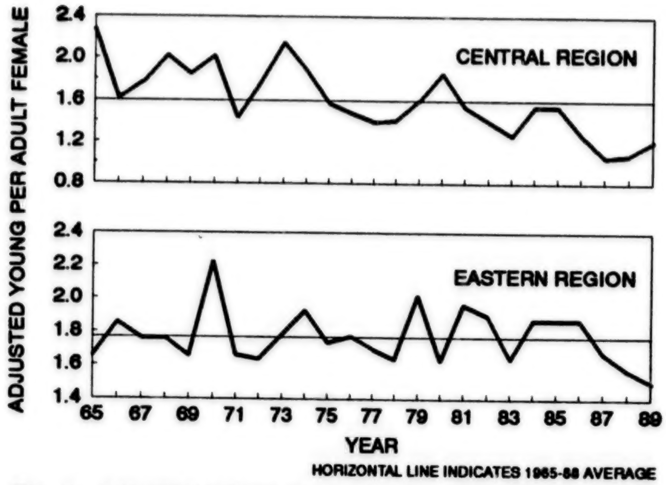

Fig. 2. Adjusted indices of recuritment, 1965-89; base year, 1969.

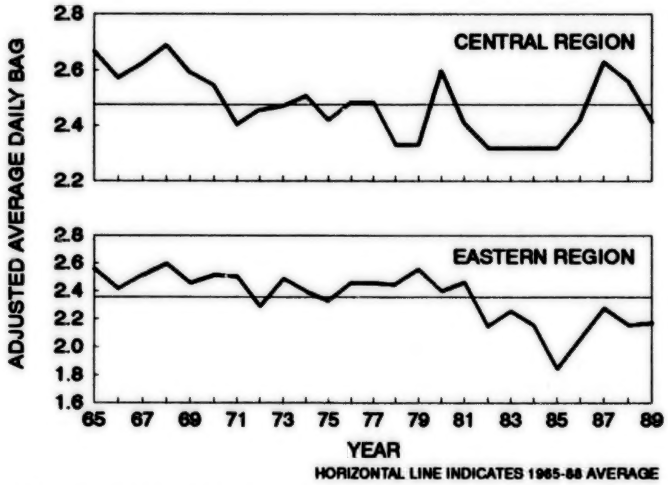

Fig. 3. Adjusted indices of daily hunting success, 1965-89; base year, 1969.

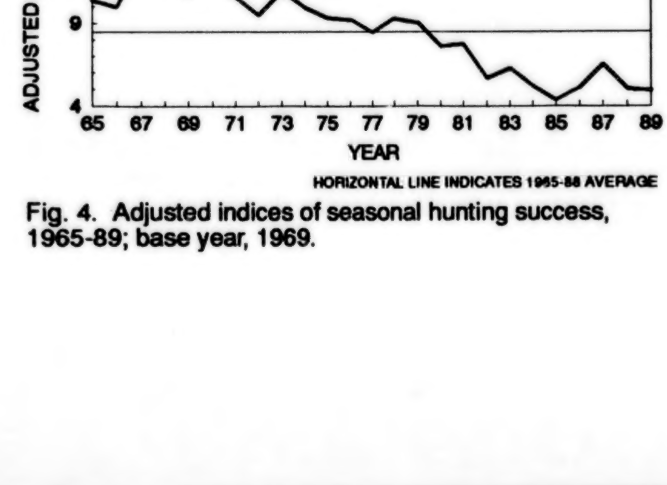

Fig. 4. Adjusted indices of seasonal hunting success, 1965-89; base year, 1969.

These indices were adjusted to a base year value for comparison with previous years. Further information on survey procedures can be found in Clark (1970, 1972, 1973).

Singing-ground Survey

Each route is located on lightly traveled secondary roads and consists of a 3.6-mile-long segment with 10 listening stops. A route is conducted shortly after sunset, by driving to each of the 10 stops. Routes are conducted by cooperating state, provincial, and federal employees or occasionally volunteers. At each stop, the observer records the number of woodcock heard singing. The total of all woodcock heard at all stops is recorded at the completion of the route. The counts are timed to coincide with peaks in seasonal and daily courtship behavior. Surveys are not conducted when wind, rain or temperature conditions might affect singing behavior or when listening conditions might be impaired.

Route Regression Methodology.--Trends were estimated for each route by fitting a line using linear regression to the natural logarithm of the original counts + 0.05 (Geissler 1984). Observer data were used as covariables in the regression to adjust for differences in observers' ability to hear woodcock. The resulting slope estimates were back-transformed and weighted average slopes were calculated for states and regions as described by Geissler (1984). Route density and variance were used as weighting factors for state and provincial estimates, while regional estimates were also weighted by state and provincial areas. A bootstrap procedure (Efron 1982) was used to estimate variances for the state, provincial, and regional slope estimates. The weighted geographic slope estimates were then converted to percent change per year. Trend significance was assessed using Z-based confidence intervals. A trend was significant if $P<0.05$, and significance was not assessed if fewer than 10 routes were run in a state, province, or region.

Changes in observers and inclusion of constant zero routes can influence woodcock density estimates and affect trend analyses (Sauer and Bortner in prep.). The effect of observer changes was included in the analyses, while constant zeros were not included in 2-year, 6-year, or 23-year analyses. Route regression analyses do not use routes on which no birds were heard during the interval of interest, hence sample sizes (number of routes) may

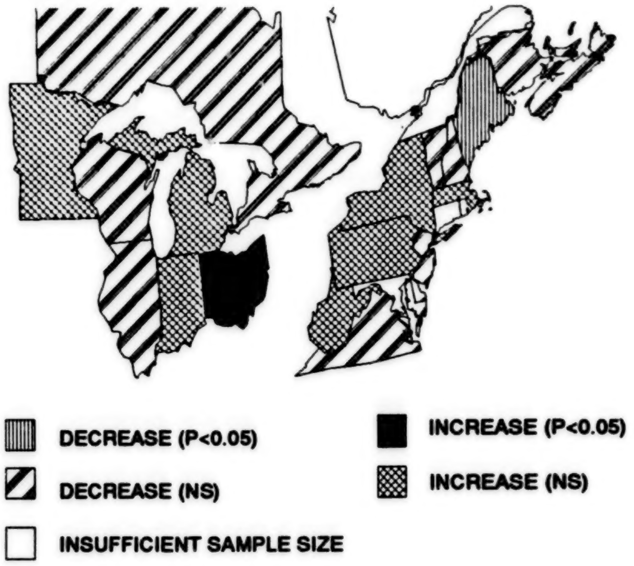

Fig. 5. Short-term American woodcock breeding population trends, 1989-90; route regression analysis.

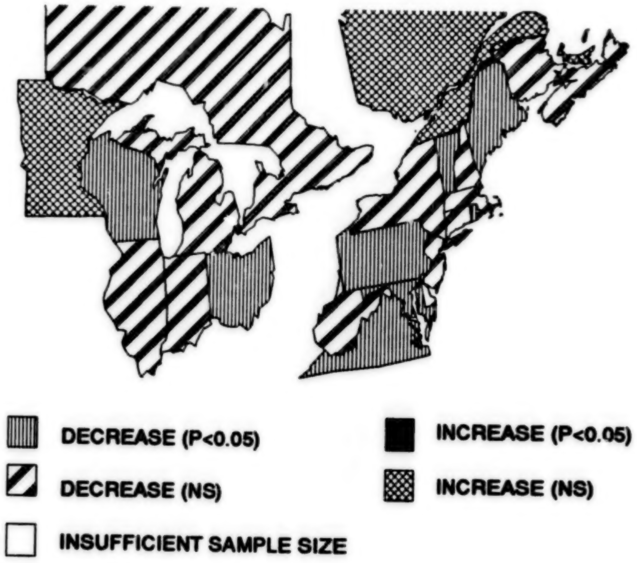

Fig. 6. Long-term American woodcock breeding population trends, 1968-90; route regression analysis.

be smaller than the actual number of routes run in a state or province.

Annual Indices Estimation.--Annual indices were calculated for regions by finding the deviation between observed counts on each route and those predicted from the regional trend estimate. The residuals were averaged by year and added to the fitted trend to provide an annual index of abundance. Yearly variation in woodcock abundance is therefore superimposed on the long-term fitted trend. The advantage of this method is that the indices provide a realistic representation of annual variation about a fitted trend. The percent change estimated from the trend analysis is the appropriate statistic of annual change, not the percent change between breeding population index values.

RESULTS

Wing-collection Survey

Approximately 4,600 potential woodcock hunters were contacted and asked to participate in the 1989-90 wing-collection survey. Thirty-six percent (1,666 hunters) (Table 1) cooperated by submitting 12,462 wings and supplemental information on 8,552 hunts. Northern hunters submitted more wings than southern hunters, leading to a skewed geographic distribution in the wing sample.

Recruitment.--The ratio of immature woodcock to adult females in the harvest provides an index of recruitment to the population during the previous breeding season. In the U.S. portion of the Eastern Region the recruitment index fell 6.3 percent from 1.6 to 1.5 immatures per adult female (Table 2). The Eastern Region recruitment index is well below the long-term average.

The recruitment index in the U.S. portion of the Central Region increased 13.3% from 1.5 to 1.7 immatures per adult female between 1988 and 1989.

The 1989 recruitment indices were adjusted to a base year value for comparison with previous years (Fig. 2). No trend is evident for the Eastern Region, except a recent decline in the past three years. The Central Region index has significantly declined during the 1965-89 survey period.

Hunting Success.--There were no changes in 1989-90 woodcock hunting regulations. Daily and seasonal success did not change in the Eastern Region; however both success indices decreased in the Central Region. In the Eastern Region the index of daily hunting success remained unchanged at 1.6 birds per day between 1988 and 1989 (Table 3). Seasonal hunting success also remained stable at 8.8 birds per season in both 1988 and 1989. In 1989 Eastern Region cooperators made 2.7% fewer hunts and bagged 0.7% more woodcock than 1988.

Central Region daily success decreased (7.7%) from 2.6 birds per hunt to 2.4 birds per hunt. The index to seasonal success decreased (6.7%) from 13.5 birds per season to 12.6 birds per season. Survey cooperators made 1.6% more hunts and bagged 6.6% fewer woodcock during the 1989 season than the 1988 season.

The 1989 indices of daily and seasonal success were adjusted to base year values for comparison with previous years (Fig. 3. and Fig. 4). Both indices have declined significantly ($P < 0.05$) over the 1965-89 survey period in both regions.

Singing-ground Survey

Route Regression.--Data from 506 routes were used in the 1990 route regression analysis of population change between 1989 and 1990. In the Eastern Region 206 routes were included, and 300 routes from the Central Region were used.

The Maine breeding population trend declined significantly between 1989 and 1990. This was the only significant decline of states and provinces in the Eastern Region (Table 4). In the Central Region, a significant increase between 1989 and 1990 was noted in the Ohio breeding population (Fig. 5). Breeding population trends were not significant in either region. The Eastern Region trend exhibited a nonsignificant 2.5% decline, and the Central Region trend increased nonsignificantly (2.5%).

Long-term (1968-90) trends were computed from 645 routes in the Eastern Region and 639 routes in the Central Region. Significant long-term declining trends were noted for Maine, Maryland, New Jersey, Pennsylvania, Rhode Island, Vermont, and Virginia (Fig. 6). The long-term trend for the Eastern Region indicates a mean annual decrease of 1.8% per year ($P < 0.001$) (Table 4). The Central Region trend has decreased at a mean annual rate of 0.8%, but this change was nonsignificant.

Annual Breeding Population Indices.--The 1990 Eastern Region breeding population index of 1.91 singing males per route (Table 5) was calculated from 310 routes and is slightly below the predicted index of 1.98 singing males per route. The Central Region population index of 2.60 males per route is above the predicted index of 2.52 males per route, based on analysis of 396 routes (Fig. 7).

DISCUSSION

Wing-collection survey

The cause of the long-term decline in the Central Region recruitment index is unknown. Preliminary investigations indicate the cause may be an artifact of the base year procedure and the weighting method. Unweighted age ratio trends do not show the same decline (Fig. 8).

Hunting success indices should be used only after recognizing the biases associated with the non-random sampling procedure used to select survey participants. Although unquantified, these biases are likely to have seriously affected the results of this survey. A comprehensive critique of these problems is beyond the scope of this report, so readers are directed to Owen (1978). Development of a statistically valid sampling frame is vital to improving this aspect of woodcock management.

EVALUATION OF RESTRICTIVE HARVEST REGULATION

At the beginning of the 1985-86 hunting season, FWS made harvest regulations more restrictive, due to concern for the Eastern Region woodcock population. Season length was reduced from 65 days to 45 days between October 1 and January 31. Bag limits were reduced from 5 per day to 3 per day.

The Eastern Region breeding population trend from the route regression methodology indicates a nonsignificant decrease of 0.18% since 1985. The breeding population in New Brunswick has significantly increased since 1985, but this is the only increase in the Eastern Region. No other state or province trends have significantly increased since 1985. Conversely, the Pennsylvania breeding population trend has significantly declined during this same period. While trends in all other states and provinces in the Eastern Region fail to show statistical significance, most are still declining.

No relationship can be inferred from the results of the Singing-ground Survey and the effects of the restrictive harvest regulations.

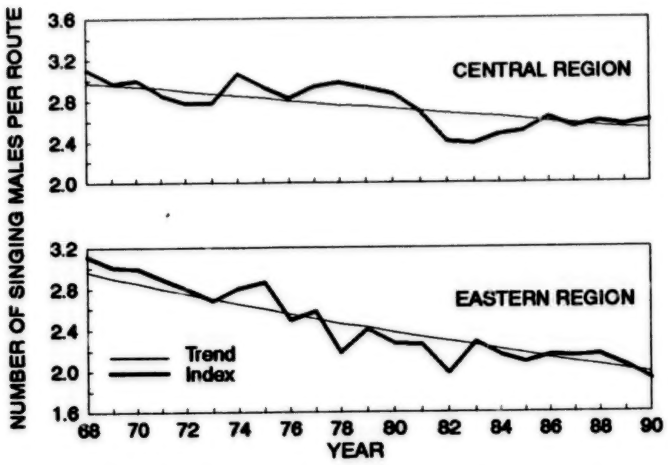

Fig. 7. American woodcock breeding population trends and annual indices, 1968-90; route regression analysis.

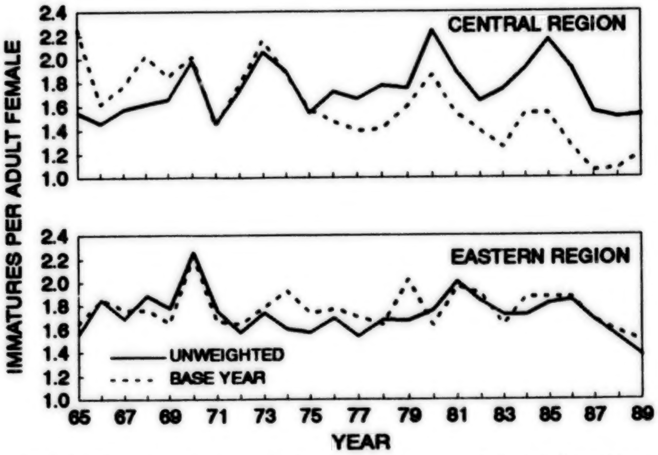

Fig. 8. Comparison of weighted and unweighted American Woodcock age ratio indices, 1965-89.

ACKNOWLEDGEMENTS

Personnel from the U.S. Fish and Wildlife Service, Canadian Wildlife Service, and the many state and provincial agencies and some private individuals cooperated in collecting the Singing-ground Survey data and at the wingbee. The 1990 wingbee was graciously hosted by the Tennessee Wildlife Resources Agency (TWRA). Special appreciation is due to M. Gudlin and all the other TWRA employees who helped during the wingbee. I would also like to thank G.A. Ammann for his help and his dedication to woodcock for the last 45 years. M. Olinde (Louisiana Dept. of Wildl. and Fish.), J. Sole (Kentucky Dept. Fish. and Wildl. Res.), T. Carlson (Michigan Dept. of Nat. Res.), D.W. Allsbrook and J.S. Atkins (Tennessee Valley Authority), assisted during the wingbee. The following U.S. Fish and Wildlife Service employees also made contributions to the success of the wingbee : E. Derleth, B. Gentry, F. Romero, S. Seikaniec, G. Sepik, and P. Yakupzack. Many woodcock hunters cooperated by sending in wings and supplemental hunting information. J. R. Sauer developed the method for calculating annual indices, refined the route regression programs for analysis of the Singing-ground Survey data, and provided general statistical guidance. L. May, F. Hicks, and H. Bourne provided computer programming and computer processing support. H. Bourne also prepared the figures. Data entry was ably conducted by the Electronic Data Processing Section of the Office of Migratory Bird Management. I express particular recognition to M.A. McKeogh, who provided valuable assistance in conducting both surveys and provided secretarial support. R.J. Blohm, J.R. Sauer, and R.I. Smith reviewed the manuscript and provided helpful comments. Special thanks are due the regional, state, and provincial Singing-ground Survey coordinators.

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Table 1. Distribution of hunters contacted and response rates in 1989-90 woodcock wing-collection survey.

State of residence	No. of contacts by Code[a]					Total Contacts	No. of Cooperators	Percentage of Contacts Cooperating
	1	2	3	4	9			
AL	5	22	3			30	2	7
AR	9	14	4			27	6	22
CT	64	48	16			128	52	41
DE	6	15	2			23	3	13
FL	7	19	4			30	2	7
GA	11	44	3			58	8	14
IL	23	34	13			70	8	11
IN	45	33	16			94	36	38
IA	14	23	6			43	13	30
KS	7	11	3			21	5	24
KY	13	24	3			40	10	25
LA	96	168	76	1		341	104	30
ME	91	108	21			220	88	40
MD	11	28	5	2		46	7	15
MA	92	92	29	8		221	76	34
MI	325	288	66	2		681	326	48
MN	129	166	35	6		336	154	46
MS	4	28	1			33	1	4
MO	30	19	20			69	22	32
NE	5	8	0			13	1	7
NH	52	60	7	2		121	57	47
NJ	42	62	73			127	43	34
NY	152	123	37	2		314	155	49
NC	20	34	9	1		64	15	23
OH	61	52	18	2		133	53	40
OK	8	20	3			31	9	29
PA	117	124	54	1		296	106	36
RI	15	22	0			37	9	24
SC	11	36	5			52	7	13
SD	0	0	1			1	0	--
TN	9	27	2	1		39	10	26
TX	10	41	3			54	6	11
VT	63	52	10			125	64	51
VA	49	48	15			112	30	27
WV	8	9	0			17	9	53
WI	165	313	46	3		527	169	32
Total	1769	2215	559	31		4574	1666	36

[a] Code 1 - Previous year's Code 1, 2, 4, and 9 hunters who submitted wings.
Code 2 - Waterfowl harvest survey hunters who reported hunting woodcock.
Code 4 - Requested participation or proposed by fellow hunter.
Code 6 - Previous year's Code 1 who did not submit wings.
Code 9 - From list provided by state, primarily from state harvest survey.

Table 2. State and regional woodcock recruitment indices based on wings submitted by hunters. Regional indices were computed from states represented by a sample of at least 125 wings in both the 1988 and 1989 hunting seasons.

State of harvest	Number of wings received		Adult females		Immatures		Immatures per adult female	
	1988	1989	1988	1989	1988	1989	1988	1989
Eastern region								
CT	174	112	34	19	112	77	3.3	4.1
FL	5	3	3	---	2	3	0.7	---
GA	24	12	7	6	11	4	1.6	0.7
ME	809	722	231	212	436	322	1.9	1.5
MD	29	10	12	4	13	4	1.1	1.0
MA	174	172	50	43	89	31	1.8	1.9
NH	264	401	73	153	146	150	2.0	1.0
NJ	142	138	31	29	83	86	2.7	3.0
NY	810	725	312	283	277	275	0.9	1.0
NC	66	46	21	16	25	24	1.2	1.5
PA	362	332	120	91	164	146	1.4	1.6
SC	13	6	2	1	9	4	4.5	4.0
VT	423	567	123	207	224	217	1.8	1.1
VA	96	75	18	16	55	46	3.1	2.9
WV	80	44	30	13	24	20	0.9	1.5
Totals	3471	3365	1067	1093	1670	1429		
	Weighted age ratios (Immatures/adult female)						1.6	1.5
	Percent change						-6.3%	
Central region								
AL	5	3	1	0	0	2	---	---
AR	13	16	3	6	9	5	3.0	0.8
IL	23	16	7	2	12	7	1.7	3.5
IN	133	219	43	40	63	134	1.5	3.4
IA	17	33	3	15	9	14	3.0	0.9
KY	8	25	1	5	4	14	4.0	2.8
LA	1011	838	241	195	612	514	2.5	2.6
MI	2980	2760	949	823	1488	1333	1.6	1.6
MN	883	829	327	322	371	312	1.1	1.0
MO	35	96	15	20	13	51	0.9	2.9
OH	264	351	98	124	103	147	1.1	1.2
TN	16	20	8	6	3	10	0.4	1.7
TX	8	16	4	1	1	10	0.3	10.0
WI	1160	988	397	363	442	379	1.1	1.0
Totals	6556	6210	2097	1922	3130	2932		
	Weighted age ratios (Immatures/adult female)						1.5	1.7
	Percent change						+13.3%	

Table 3. State and regional indices to daily and seasonal woodcock hunting success. Regional indices computed using states having at least 10 successful hunters participating in both the 1988 and 1989 seasons.

State of residence	Number of hunters	Number of hunts		Woodcock bagged		Average bag per hunt		Average bag per season	
		1988	1989	1988	1989	1988	1989	1988	1989
Eastern region									
CT	20	92	59	160	105	1.7	1.8	8.0	5.3
FL	1	3	3	5	3	1.7	1.0	5.0	3.0
GA	2	2	8	3	12	1.5	1.5	1.5	6.0
ME	47	254	252	529	499	2.1	2.0	11.3	10.6
MD	3	12	6	25	9	2.1	1.5	8.3	3.0
MA	28	95	98	146	158	1.5	1.6	5.2	5.6
NH	26	105	151	197	331	1.9	2.2	7.6	12.7
NJ	17	62	69	112	134	1.8	1.9	6.6	7.9
NY	75	386	335	724	639	1.9	1.9	9.7	.5
NC	9	33	29	66	46	2.0	1.6	7.3	5.1
PA	49	172	167	319	312	1.9	1.9	6.5	6.4
RI	3	18	5	35	7	1.9	1.4	11.7	2.3
SC	2	3	5	4	6	1.3	1.2	2.0	3.0
VT	42	208	238	385	488	1.9	2.1	9.2	11.6
VA	12	42	34	87	71	2.1	2.1	7.3	5.9
WV	5	33	20	70	33	2.1	1.7	14.0	6.6
Totals	341	1520	1479	2832	2853				
		Weighted average bags				1.6	1.6	8.8	8.8
		Percent change				0%		0%	
Central region									
AL	1	2	1	3	1	1.5	1.0	3.0	1.0
AR	3	7	11	13	12	1.3	1.1	4.3	4.0
IL	4	8	9	23	15	2.9	1.7	5.8	3.8
IN	16	57	86	129	191	2.3	2.2	8.1	11.9
IA	6	11	17	17	33	1.5	1.9	2.8	5.5
KY	3	4	13	8	24	2.0	1.8	2.7	8.0
LA	56	284	280	976	817	3.3	2.9	17.4	14.6
MI	194	1097	1105	2738	2526	2.5	2.3	14.1	13.0
MN	63	319	317	849	755	2.7	2.4	13.5	12.0
MO	10	24	28	33	78	1.4	2.8	3.3	7.8
OH	28	109	127	264	347	2.4	2.7	9.4	12.4
TN	5	10	11	16	20	1.6	1.8	3.2	4.0
TX	1	2	1	8	1	4.0	1.0	8.0	1.0
WI	74	388	352	1002	859	2.6	2.4	13.5	11.6
Totals	464	2322	2358	6079	5679				
		Weighted average bags				2.6	2.4	13.5	12.6
		Percent change				-7.7%		-6.7%	

Table 4. Trends (% change per year[a]) as determined by linear regression in numbers of American woodcock heard along Singing Ground Survey routes.

Management unit/state	2-year (1989-90)			6-year (1985-90)		23-year (1968-90)	
	N[b]	% change	Routes run[c]	N	% change	N	% change
EASTERN	206	-2.50	322	352	-0.18	645	-1.80 ***[d]
CT	2	0.00	4	4	-11.77	10	-7.82
ME	38	-20.57 ***	47	52	-3.13	62	-2.15 **
MD	2	12.22	7	7	-12.10	24	-6.86 ***
MA	13	5.99	15	13	-5.70	20	-4.82
NB	30	-9.67	39	49	4.65 **	64	-1.95
NH	6	-2.33	13	13	-0.28	18	-0.03
NJ	6	-7.38	10	9	-14.10	15	-6.96 ***
NY	41	8.83	61	69	0.94	104	-1.14
NS	17	-12.64	31	34	-2.83	52	-2.09
PA	8	44.81	32	17	-14.65 **	64	-4.93 ***
PEI	7	-33.68	9	9	0.37	12	2.17
QUE	0	--	0	16	15.68	57	3.17 **
RI	0	--	0	0	--	3	-7.68 ***
VA	8	-8.42	17	20	-3.83	69	-7.02 ***
VT	14	-12.54	17	17	5.68	22	-2.56 **
WV	14	6.70	20	23	-5.84	49	-1.33
CENTRAL	300	2.54	442	453	0.69	639	-0.78
IL	5	-64.10	20	11	-35.14 ***	38	-2.05
IN	9	44.00	22	17	5.38	50	-3.79
MI	100	4.48	117	124	1.10	136	-0.79
MN	56	5.52	76	76	1.32	108	0.79
OH	18	79.14 ***	34	31	-1.10	69	-4.01 **
ON	58	-4.18	84	112	-0.26	130	-0.28
WIS	54	-6.13	89	82	1.05	108	-1.63 **
Continent	506	1.47 **	764	805	0.51	1284	-1.14 **

[a] Mean of route trends weighted by land area and population density. The estimated count in the next year is (%/100+1) times the count in the current year where % is the annual change. NOTE: Extrapolating the estimated trend statistic (% change per year) over time (e.g., 23 years) may exaggerate the total change over the period.

[b] Routes run in both 1989 and 1990 with comparable observers and densities greater than zero.

[c] Actual routes run in 1990.

[d] ** $P<0.05$; *** $P<0.01$.

Table 5. Breeding population indices[a] for American woodcock using results of Singing Ground Surveys, 1968-89.

Management region state/province	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Eastern	3.11	3.01	2.99	2.89	2.80	2.68	2.81	2.86	2.49	2.58	2.18	2.40	2.27	2.26	1.98	2.28	2.16	2.09	2.15	2.14	2.16	2.05	1.91
CT	[b]	3.64	3.52	2.91	3.68	2.74	2.72	2.91	1.60	1.72	1.13	1.15	1.01	1.36	1.76	1.36	0.98	0.95	1.24	0.71	1.45	0.65	0.59
ME	4.65	4.66	5.04	4.56	4.40	4.60	4.62	4.89	4.24	3.91	3.56	3.88	3.46	3.81	2.65	3.41	3.37	3.34	3.56	3.85	3.56	3.41	2.70
MD	2.90	2.83	2.56	2.41	2.04	2.29	2.03	1.96	1.39	1.46	1.60	1.32	1.42	1.25	1.37	0.98	0.86	0.92	0.75	0.68	0.72	0.67	0.64
MA	[b]	3.30	3.81	4.46	3.19	4.27	3.32	2.01	2.69	2.03	2.54	2.61	1.85	1.89	1.60	1.22	2.02	1.61	1.70	1.74	1.80	1.41	1.29
NB	[b]	5.67	5.95	5.39	5.74	4.87	5.46	6.42	4.74	5.43	4.03	4.46	4.04	4.14	4.06	4.36	3.85	4.00	3.30	3.83	3.89	4.96	4.24
NH	[b]	3.19	3.69	2.98	3.69	2.86	3.90	3.29	3.98	3.52	3.43	3.42	3.86	4.32	2.51	2.93	2.60	2.76	4.67	3.30	3.36	3.25	3.05
NJ	3.34	2.43	3.79	4.61	3.02	4.32	4.24	3.20	1.83	2.00	1.39	2.41	1.45	1.22	1.43	1.35	1.52	1.17	1.24	1.33	1.05	1.11	0.66
NY	3.75	4.12	3.13	3.58	3.45	3.45	3.66	3.19	3.23	3.36	2.67	3.07	3.57	3.25	2.65	3.28	2.51	3.25	2.79	2.49	2.88	2.45	2.80
NS	3.93	2.78	2.39	2.86	2.47	2.60	2.98	2.78	2.45	2.34	2.56	2.14	1.96	1.81	1.54	1.96	1.98	1.89	2.26	2.10	2.08	2.05	1.62
PA	2.24	1.98	2.32	1.91	1.72	1.79	1.33	1.61	1.46	1.51	1.15	1.17	1.17	1.15	0.97	1.09	1.13	0.90	1.08	1.07	0.86	0.75	0.85
PE	[b]	2.08	1.86	2.50	2.15	1.73	2.47	3.62	3.28	2.89	2.31	2.81	2.12	1.75	1.90	2.95	3.07	2.59	3.61	3.12	4.23	3.85	3.07
PQ	[b]	[b]	[b]	2.78	2.61	2.12	2.52	2.50	2.04	2.22	2.83	2.85	3.12	2.71	2.68	3.46	3.18	3.28	3.58	3.88	[b]	[b]	[b]
RI	[b]	0.86	1.02	1.62	1.38	1.38	1.03	0.80	0.80	[b]	0.27	0.46	0.46	0.27	1.11	0.63	0.67	0.22	0.22	[b]	0.32	0.32	[b]
VT	[b]	2.64	4.47	3.29	3.81	3.20	3.13	3.74	3.36	3.91	2.79	2.77	2.50	2.23	1.65	2.46	2.43	1.83	2.34	2.49	2.71	2.54	2.52
VA	[b]	1.77	1.85	1.46	1.31	0.99	1.49	1.32	1.01	1.16	0.84	0.98	0.78	0.85	0.85	0.72	1.01	0.58	0.56	0.60	0.49	0.45	0.38
WV	1.26	1.43	1.07	1.01	1.23	1.04	0.89	1.13	1.02	1.08	0.74	1.05	0.89	1.21	1.04	1.14	0.87	0.88	0.86	0.92	0.76	0.79	0.81
Central	3.09	2.97	2.99	2.86	2.78	2.78	3.06	2.93	2.82	2.94	2.98	2.92	2.87	2.69	2.41	2.38	2.47	2.51	2.63	2.54	2.59	2.56	2.60
IL	[b]	[b]	0.33	0.34	0.32	0.31	0.29	0.35	0.27	0.29	0.27	0.29	0.23	0.26	0.19	0.29	0.21	0.34	0.25	0.28	0.22	0.27	0.24
IN	1.67	1.25	1.18	0.94	1.18	1.25	0.96	0.97	0.99	0.98	0.81	1.10	0.82	0.88	0.65	0.69	0.68	0.58	0.76	0.71	0.55	0.62	0.67
MI	5.09	4.96	4.74	4.58	4.36	4.70	5.41	5.46	5.07	4.70	5.05	5.02	4.97	4.15	4.38	3.69	4.23	4.43	4.48	4.14	4.38	4.32	4.17
MN	[b]	3.21	2.74	3.23	2.76	3.04	3.85	3.44	3.30	3.34	3.48	3.49	3.73	3.53	3.32	3.02	2.73	3.19	3.47	3.35	3.66	3.43	3.66
OH	[b]	[b]	1.92	1.87	1.68	1.37	1.61	1.31	1.54	1.76	1.34	1.07	1.03	1.23	0.91	1.29	1.13	0.97	0.83	0.95	1.02	0.77	0.95
ON	5.05	5.66	5.32	5.23	5.49	4.99	5.55	5.09	4.71	5.51	5.89	5.68	6.01	5.75	4.38	4.51	4.80	4.88	4.99	4.94	4.75	5.22	5.36
WI	3.64	3.35	3.84	3.29	3.16	3.26	3.36	3.22	3.06	3.30	3.55	3.31	2.95	2.56	2.46	2.49	2.74	2.54	2.98	2.76	2.81	2.62	2.59
Continental	3.06	2.97	2.97	2.86	2.78	2.73	2.92	2.89	2.65	2.75	2.55	2.65	2.55	2.47	2.20	2.33	2.32	2.31	2.40	2.35	2.39	2.32	2.28

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[a] Annual indices are calculated using predicted values from trend analysis plus the deviation between the expected value and the observed value in a year.

[b] No random survey route data are available.

END

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